Measurement of ^{197}Au(^{11}C,xn) with BEARS

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Our first experiment with an accelerated radioactive ^{11}C beam, the measurement of the excitation functions of (^{11}C,xn) reactions on gold, was completed this year [1] after preliminary results in 1998 [2]. The data was taken during three runs that were also used for development and commissioning of the BEARS system at the 88-Inch Cyclotron [3].

The experiment was performed by bombarding a set of gold targets with a ^{11}C beam for short periods, then observing the α decay of the astatine isotopes produced. Three separate gold targets separated by energy degrader foils were used in order to measure three different energies at once. The production of five isotopes was measured, ranging from ^{204}At to ^{200}At, corresponding to the emission of 4 to 8 neutrons from the compound nucleus. The results for ^{203}At, ^{202}At and ^{201}At are shown in Fig. 1.

Also shown in Fig. 1 are the results of a fusion-evaporation calculation. Certain parameters in the calculation have been chosen to give a reasonable fit to similar results from reactions with a stable ^{12}C beam, ^{197}Au(^{12}C,xn). The correspondence between the calculation and experiment is reasonable given the expected predictive power of the statistical model used. The overprediction for the (^{11}C,5n) and (^{11}C,7n) channels was found to mirror a similar overprediction for the (^{12}C,6n) and (^{12}C,8n) reactions leading to the same final astatine isotopes. The measured ratios of the cross sections for (^{11}C,xn) and (^{12}C,(x+1)n), that lead to the same isotope, were found to be in quite good agreement with the calculation.

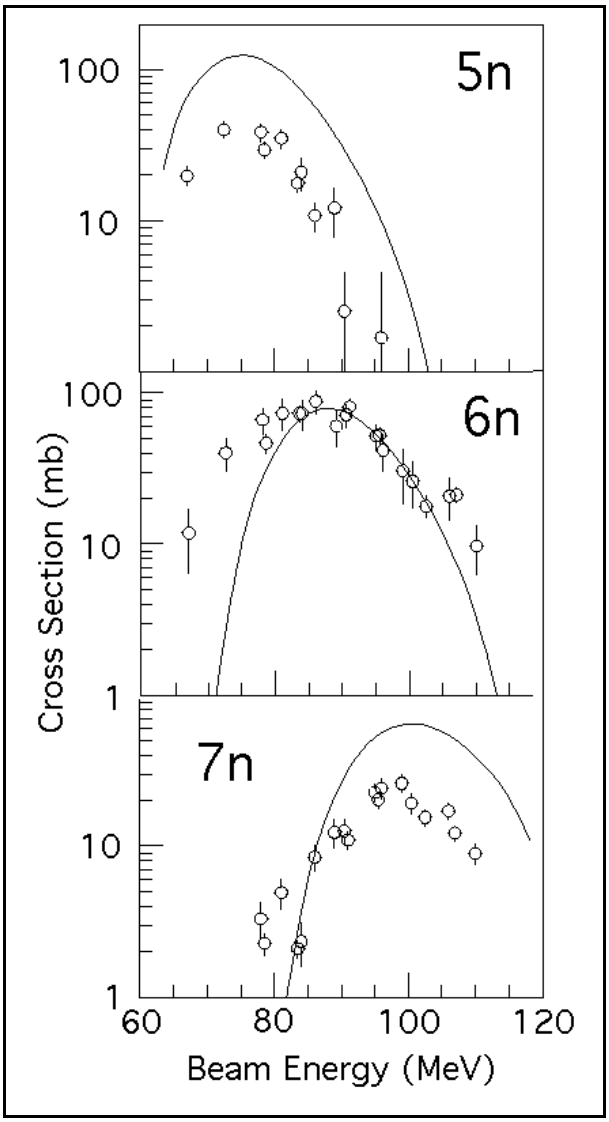

Fig. 1. Excitation functions for the reaction of ^{11}C on a ^{197}Au target with the subsequent emission of 5, 6 or 7 neutrons (upper, middle and lower panels), resulting in the astatine isotopes ^{203}At, ^{202}At and ^{201}At. The solid lines are predictions from a model calculation.

Footnotes and References

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1. R. Joosten *et al.*, submitted to Phys. Rev. Lett.

2. R. Joosten *et al.*, last year's annual report.

3. J. Powell *et al.*, submitted to Nucl. Inst. and Meth.